REMARKS

The various parts of the Office Action (and other matters, if any) are discussed below under appropriate headings.

1. Claim Amendments

Claim 1 has been amended to recite "wherein the means for producing harmonics comprises a harmonic generator configured to produce out-of-band harmonics…" In a telephone interview on March 18, 2009, the Examiner indicated that the above claim amendment would be acceptable and would not raise new issues requiring further search. Accordingly, Applicant respectfully requests entry of the above claim amendments and favorable reconsideration of the claims.

2. Claim Rejections - 35 U.S.C. § 103

Claims 1 and 12–14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,335,973 to Case in view of U.S. Patent No. 4,853,963 to Bloy. Applicant respectfully requests withdrawal of this rejection for at least the following reasons.

Independent claim 1 recites a device for increasing the perceived bandwidth in an audio signal path with limited bandwidth. The claimed device includes, *inter alia*, a harmonic generator configured to produce out-of-band harmonics of a polyphonic ring signal. Claim 1 further recites a combiner for adding the out-of-band harmonics to a first part of the polyphonic ring signal. As claimed, the out-of-band harmonics increase the perceived sound pressure level of the polyphonic ring signal and thereby improve the alert function of the ring signal.

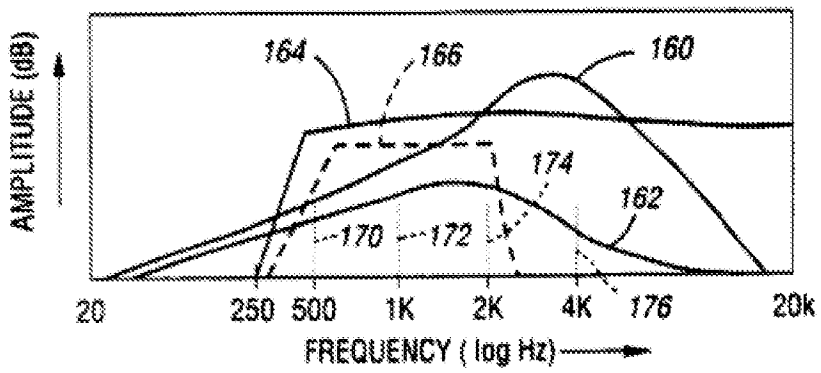
As mentioned in the instant specification, the sound generators in mobile telephones typically restrict the audio bandwidth to 3.4kHz. However, this creates a dull sonic expression, like AM radio, and makes it harder for a user to hear when the phone is ringing. A ring signal is only useful if it can attract the attention of the user. Applicant recognized that a ringer needs high frequency content in order to attract the attention of the user, especially in noisy situations. Thus, the claimed invention adds high

frequency content in the form of out-of-band harmonics to a polyphonic ring signal in order to provide an improved alert function.

The Examiner acknowledges that neither Case nor Bloy teach adding out-of-band harmonics to an audio signal, let alone a polyphonic ring signal, as claimed. However, the Examiner asserts that in light of Case and Bloy it would have been obvious to try adding out-of-band harmonics to a signal with a reasonable expectation of success in order to restore voice character and increase intelligibility. Applicant respectfully submits that a skilled person would not have modified Case in view of Bloy to arrive at the claimed invention, at least because the proposed modification would render the Case system unsatisfactory for its intended purpose and/or change its principle of operation (MPEP § 2143.01).

Case is primarily directed to improving the audio quality of speech signals for hearing aids by adding harmonics of a speech signal within the lower bandwidth of a hearing impaired individual (col. 5, lns. 46–61). Case also describes using harmonic enhancement of voice signals to overcome hashing noises commonly found in telephony systems (col. 7, lns. 54–56). In addition, the reference mentions that the harmonic enhancement techniques described therein may be applied to "very low bandwidth signals, such as data compressed audio signals, computer voice files, computer audio files, and numerous other technologies which have an audio response less than normal human perception" (col. 8, lns. 35–44).

Figure 13 of Case



As shown in figure 13 (reproduced above), the Case disclosure adds harmonics (172, 174, and 176) to an input signal (170) only at frequencies within the lower bandwidth (162) of a hearing impaired individual (col. 5, lns 33–51). Case further states that the use of harmonic generation at much lower frequencies inside of the audible bandwidth of the user allows the addition of harmonics to four octaves of hearing before the harmonics are perceived as distortion (col. 6, lns. 42–51). This allows the Case harmonics to possibly enhance the entire remaining hearing range of a hearing impaired person without boosting as much high frequency gain as conventional techniques (col. 6, lns. 51–56).

Bloy has no appreciation of the need to create harmonics within an audible bandwidth of a hearing impaired person. Instead, Bloy teaches the use of a digital signal processing method that provides reconstitution of those out-of-band harmonics that otherwise would not be detected by the person (of normal hearing) receiving the signal transmission. According to Bloy, the high frequency components of voice signals are heavily attenuated during narrow band transmission, causing the out-of-band harmonics that define normal voice character to be removed from the voice signals. The Bloy digital signal processing method purportedly restores the normal voice character of these voice signals by reconstituting the out-of-band harmonics.

If a skilled person were to modify the Case system by replacing the in-band harmonics with the Bloy out-of-band harmonics, the result would be a hearing aid that provides audio signals with added harmonics at frequencies *outside* the audible bandwidth of the hearing impaired user. This is because while in Bloy the out-of-band harmonics are those that are attenuated by a narrow pass band, in Case "out-of-band" harmonics would be the harmonics generated at frequencies outside the user's audible bandwidth 162, but within the normal hearing range 160. Consequently, referring back to figure 13 of Case, if out-of-band harmonics were added to input signal 170, they would build on the existing octaves (172, 174, 176) and appear at 8kHz and 16 kHz, thereby extending outside the audible bandwidth 162.

Thus, the proposed modification would render the Case hearing aid inoperable for its intended purpose of improving audio quality for the hearing impaired by

generating an audio signal that has no detectable harmonic enhancement, as the added harmonics are outside the audible bandwidth of the hearing impaired user. As such, a skilled person looking at Case and Bloy would not have thought to add the Bloy out-of-band harmonics to the Case audio signal.

The Examiner also contends that polyphonic ring signals are well known in the art and therefore, it would have been obvious to apply known harmonic enhancement techniques to improve the quality of known polyphonic ring signals. However, even if the Examiner's contention is correct, the claimed invention would not result because the *addition of out-of-band harmonics* to an audio signal is not a known technique for improving signal quality, as it is not disclosed by the cited art. Therefore, even if polyphonic ring signals are known, the prior art teaches, at most, adding in-band harmonics to a polyphonic ring signal to improve audio quality.

Moreover, even if adding out-of-band harmonics to an audio signal for improving signal quality were a known technique, a skilled person looking to improve a polyphonic ring signal would not have attempted to add out-of-band harmonics to the ring signal. As explained in the specification, higher order harmonics should be added to a polyphonic ring signal than to a voice signal because the added harmonics should provide a suitable addition to the initial bandwidth, and what is "suitable" differs for voice signals and ring signals (see, e.g., pg. 3, lns. 9–18). For example, Applicants have determined that by adding out-of-band harmonics in the range of 5 kHz to a 3.4kHz polyphonic ring signal, the enhanced ringer may be clearly noticeable even in noisy situations. In contrast, in both Case and Bloy, the enhancement goal is to preserve or recreate the normal voice character. Consequently, if the out-of-band harmonics required to restore normal voice character were added to a polyphonic ring signal, the resulting ring signal would sound more natural, rather than serving the purpose of a ring signal: to provide an alert function. Therefore, based on the prior art, a skilled person attempting to add out-of-band harmonics to a polyphonic ring signal would not have a reasonable expectation of success in terms of improving the alert function of the polyphonic ring signal.

In sum, none of the references cited by the Examiner disclose or make obvious a

harmonic generator configured to produce out-of-band harmonics of a polyphonic ring signal in order to increase a perceived sound pressure level of the polyphonic ring signal and thereby improve an alert function of the polyphonic ring signal, as recited in claim 1.

For at least the reasons stated above, claim 1 and all claims depending from claim 1 recite patentable subject matter.

Claims 2–4 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Case in view of Bloy, in further view of U.S. Patent No. 5,923,766 to Oda, and in further view of U.S. Patent No. 5,828,755 to Feremans. Withdrawal of this rejection for at least the following reasons is respectfully requested.

Oda is directed to an audio conversion circuit that compensates for low frequency audio components that are lower than the frequency a speaker can reproduce and are supplied to a speaker having poor low frequency response. Oda discloses the low frequency component of an input audio signal being filtered and extracted to generate even numbered harmonics. Secondary harmonics are extracted from these even numbered harmonics, amplified to an appropriate level, and then added to the original input signal.

Feremans discloses a method for improving and/or altering the quality of audio signals by isolating a number of signals from the input signals, generating higher harmonics of those isolated signals, amplifying the higher harmonics, and then combining the higher harmonics with either the original signal or a treated version of the original signal.

Claims 2, 3, 4, 6, and 7 depend from claim 1. Neither Oda nor Feremans makes up for the above-described deficiencies of the proposed combination of references. Therefore, claims 2, 3, 4, 6, and 7 are allowable for at least the reasons set forth above.

Claims 6 and 7 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Case in view of Bloy and in further view of Oda.

Claim 5 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Case in view of Bloy, Oda, and Feremans, and in further view of U.S. Patent No. 6,865,430 to Runton. Withdrawal of this rejection for at least the following reasons is

respectfully requested.

Runton is directed to an apparatus that may be provided in software as instructions to a digital signal processor for enhancing digital audio signals after compression and decompression. Runton discloses receiving a digital decompressed audio signal and splitting the signal into two parts. One part of the signal is harmonically enhanced and the other part has warmth added to it. Both parts of the signal are then combined and frequency equalized to provide the digitally enhanced output signal.

Claim 5 depends from claim 1. Runton does not make up for the above-described deficiencies of the proposed combination of references. Therefore, claim 5 is allowable for at least the reasons set forth above.

Claim 11 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Case in view of Bloy and in further view of U.S. Patent No. 6,606,388 to Townsend. Withdrawal of this rejection for at least the following reasons is respectfully requested.

Townsend is directed to a technique for enhancing audio signals generated from compressed digital audio files. The first two processing modules create harmonic sequences from the low frequency components and then the high frequency components contained in the original input signals. A third processing module adds and subtracts delayed and filtered versions of the enhanced input signal with itself to create left and right channeled stereo-like outputs.

Claim 11 depends from claim 1. Townsend does not make up for the above-described deficiencies of the proposed combination of references. Therefore, claim 11 is considered allowable for at least the reasons set forth above.

Accordingly, reconsideration and withdrawal of all rejections under 35 U.S.C. § 103(a) is respectfully requested.

3. Conclusion

In light of the foregoing, it is respectfully submitted that the present application is in condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in condition for allowance, the Examiner is invited

to initiate a telephone interview with the undersigned representative to expedite prosecution of the present application.

If there are any fees resulting from this communication, please charge same to our Deposit Account No. 18-0988, our Order No. SALBP0127US.

Respectfully submitted,

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/Warren A. Sklar/ **March 24, 2009**
Warren A. Sklar Date